

In re Patent Application of:

AMMAR

Serial No. 09/863,030

Filing Date: May 22, 2001

In the Claims:

1. (TWICE AMENDED) A thick film millimeter wave transceiver module comprising:

base plate;

a multi-layer, thick film substrate board formed from a plurality of layers planar sheets of low temperature co-fired ceramic material stacked together to form a single, planar substrate board having a planar bottom surface and planar top surface, and received on said base plate and a plurality of MMIC chips directly attached to the top surface of the substrate board and operable to transmit and receive millimeter wavelength signals, said substrate board layers comprising at least one of

a DC signals layer formed from a separate sheet and having signal tracks and connections;

a ground layer formed from a separate sheet and having ground connections;

a device layer formed from a separate sheet and having capacitors and resistors embedded therein that connect to MMIC chips;

a top layer planar sheet of low temperature co-fired ceramic material positioned at the top surface of the substrate board and having cutouts for receiving the MMIC chips therein;

a solder preform layer located between said device layer and said top layer for securing any MMIC chips; and

a channelization plate received over the multi-layer top surface of the substrate board and having channels formed

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to receive the MMIC chips and provide air isolation between transmit and receive signals.

2. (original) A thick film millimeter wave transceiver module according to Claim 1, and further comprising isolation vias which extend through multiple layers down to the ground layer.

3. (original) A thick film millimeter wave transceiver module according to Claim 1, and further comprising a radio frequency cover received over said channelization plate.

4. (original) A thick film millimeter wave transceiver module according to Claim 1, wherein each of said layers within said multi-layer substrate board is about 2 to about 4 mil thick.

5. (original) A thick film millimeter wave transceiver module according to Claim 4, wherein said layers are about 3 mil thick.

6. (original) A thick film millimeter wave transceiver module according to Claim 5, wherein said top layer is about 4 mil thick.

7. (original) A thick film millimeter wave transceiver module according to Claim 1, wherein said base plate is formed from a CTE matched material.

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8. (original) A thick film millimeter wave transceiver module according to Claim 1, wherein said base plate is about 0.1 to about 0.3 inches thick.

9. (original) A thick film millimeter wave transceiver module according to Claim 8, wherein said base plate is about 0.125 inches thick.

10. (TWICE AMENDED) A multi-layer thick film substrate board used in millimeter wave transceiver modules comprising:

a plurality of planar sheets of low temperature transfer tape layers stacked together to form a single, planar substrate board having a planar bottom surface and planar top surface on which a plurality of MMIC chips are mounted and operable to transmit and receive millimeter wavelength signals, said layers and comprising one of at least:

a DC signals layer formed from a separate sheet and having embedded DC signal tracks and connections;

a ground layer formed from a separate sheet having ground connections; and

a device layer formed from a separate sheet having capacitors and resistors embedded therein that connect to MMIC chips.

~~a top layer having cut outs that receives MMIC chips therein; and~~

~~a solder preform layer located between said device layer and said top layer for securing any MMIC chips received within the cut outs of the top layer.~~

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11. (original) A multi-layer thick film substrate board according to Claim 10, and further comprising isolation vias which extend through multiple layers down to the ground layer.

12. (original) A substrate board according to Claim 10, wherein each of said layers within said multi-layer substrate board is about 1 to about 4 mil thick.

13. (original) A substrate board according to Claim 12, wherein said layers are about 3 mil thick.

14. (original) A substrate board according to Claim 10, wherein said top layer is about 4 mil thick.

15. (original) A substrate board according to Claim 10, wherein said base plate is formed from a CTE matched material.

16. (TWICE AMENDED) A thick film millimeter wave transceiver module comprising:

base plate;

a multi-layer, thick film substrate board received on said base plate and formed from a plurality of layers planar sheets of low temperature co-fired ceramic material stacked together to form a single planar substrate board having a planar bottom surface and planar top surface, said layers comprising one of at least

a DC signals layer formed from a separate sheet and having embedded DC signal tracks and connections;

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a ground layer formed from a separate sheet having ground connections;

a device layer formed from a separate sheet having capacitors and resistors embedded therein;

a ~~top layer~~ sheet having cut-outs secured at the top surface for receiving MMIC chips;

~~a solder preform layer located between the device layer and top layer;~~

~~at least one a plurality of MMIC chips surface mounted received on the top surface solder preform layer and secured by a solder connection thereto and operatively connected to said layers, including said embedded DC signal tracks and connections and capacitors and resistors embedded in the device layer DC signals, ground and capacitors and resistors and operable to transmit and receive millimeter wavelength signals; and~~

a channelization plate received over the formed multi-layer substrate board and having channels formed to receive MMIC chips and provide air isolation between transmit and receive signals.

17. (original) A thick film millimeter wave transceiver module according to Claim 16, and further comprising isolation vias which extend through multiple layers down to the ground layer.

18. (ONCE AMENDED) A thick film millimeter wave transceiver module according to Claim 16, and further comprising a solder preform layer for securing the plurality of at least one MMIC chips to said substrate board.

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19. (ONCE AMENDED) A thick film millimeter wave transceiver module according to Claim 16, and further comprising a silver epoxy securing the plurality of at least one MMIC chips to the substrate board.

20. (original) A thick film millimeter wave transceiver module according to Claim 16, and further comprising a radio frequency cover received over said channelization plate.

21. (original) A thick film millimeter wave transceiver module according to Claim 16, wherein each of said layers within said multi-layer substrate board is about 2 to about 4 mil thick.

22. (original) A thick film millimeter wave transceiver module according to Claim 21, wherein said layers are about 3 mil thick.

23. (original) A thick film millimeter wave transceiver module according to Claim 16, wherein said base plate is formed from a CTE matched material.

24. (original) A thick film millimeter wave transceiver module according to Claim 23, wherein said base plate is about 0.1 to about 0.3 inches thick.

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25. (original) A thick film millimeter wave transceiver module according to Claim 24, wherein said base plate is about 0.125 inches thick.

26. (TWICE AMENDED) A method of forming a thick film millimeter wave transceiver module comprising the steps of:

forming a base plate;

forming a thick film, multi-layer substrate board by stacking from a plurality of layers planar sheets of low temperature co-fired ceramic material to form a single planar substrate board having a planar bottom surface and planar top surface on which MMIC chips are mounted and operable to transmit and receive millimeter wavelength RF signals;

receiving the thick film, multi-layer substrate board on the base plate, wherein the substrate board comprises one of at least

a DC signals layer formed from a separate sheet and having signal tracks and connections;

a ground layer formed from a separate sheet having ground connections;

a device layer formed from a separate sheet having capacitors and resistors embedded therein; and

~~a top layer having cutouts for receiving MMIC chips therein; and~~

securing the MMIC chips by solder onto the top surface of the thick film multi-layer substrate board such that and operatively connecting the MMIC chip operatively connects to capacitors and resistors embedded within the

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device layer and other layers via interconnects within the
thick film substrate board.